

Mean Areas and Heliographic Latitudes of Sun-spots in the Year 1904, deduced from Photographs taken at the Royal Observatory, Greenwich; at Dehra Dûn; at Kodaikânal Observatory, India; and in Mauritius.

(Communicated by the Astronomer Royal.)

The results here given are in continuation of those printed in the *Monthly Notices*, vol. lxxv. p. 151, and are deduced from the measurements of photographs taken at the Royal Observatory, Greenwich; at Dehra Dûn; at the Kodaikânal Observatory, India; and at the Royal Alfred Observatory, Mauritius.

Table I. gives the mean daily area of umbræ, whole spots, and faculæ for each synodic rotation of the Sun in 1904; and Table II. gives the same particulars for the entire year 1904 and the three preceding years for the sake of comparison. The areas are given in two forms: first, projected areas; that is to say, as seen and measured on the photographs, these being expressed as millionths of the Sun's apparent disc; and next areas as corrected for foreshortening, the areas in this case being expressed in millionths of the Sun's visible hemisphere.

Table III. exhibits for each rotation in 1904 the mean daily area of the whole spots (corrected for foreshortening) and the mean heliographic latitude of the spotted area for spots north and for spots south of the equator, together with the mean heliographic latitude of the entire spotted area and the mean distance from the equator of all spots; and Table IV. gives the same information for the year as a whole, similar results for the three preceding years being added, as in the case of Table II.

Tables II. and IV. are thus in continuation of the similar tables for the years 1874 to 1888 on pp. 381 and 382 of vol. xlix. of the *Monthly Notices*, and for the years 1889 to 1902 on pp. 465 and 466 of vol. lxiii., and for the years 1901 to 1903 on pp. 152 and 153 of vol. lxxv.

The rotations in Table I. and Table III. are numbered in continuation of Carrington's series (*Observations of Solar Spots made at Redhill*, by R. C. Carrington, F.R.S.), No. 1 being the rotation commencing 1853 November 9. The assumed prime meridian is that which passed through the ascending node at mean noon of 1854 January 1, and the assumed period of the Sun's sidereal rotation is 25.38 days. The dates of the commencement of the rotations are given in Greenwich civil time, reckoning from mean midnight.

The principal features of the record for 1904 are:

1. The comparatively slow, though steady, increase in the mean daily spotted area, the umbræ showing an advance on 1903 of only 32 per cent.; the whole spots of 44 per cent. The years in the two preceding cycles showing this relation to the years which they followed were 1882 and 1893, when the actual maximum was very close at hand.

TABLE I.

No. of Rotation.	Date of Commencement of each Rotation.	No. of Days on which Photographs were taken.	Mean of Daily Areas.					
			Projected.			Corrected for Foreshortening.		
			Umbrae.	Whole Spots.	Faculae.	Umbrae.	Whole Spots.	Faculae.
672	1903. d Dec. 20.64	26	57	353	1164	46	287	1338
673	1904. Jan. 16.98	27	93	638	883	65	456	1000
674	Feb. 13.32	26	61	401	899	45	296	1015
675	Mar. 11.65	27	75	483	1413	52	347	1532
676	Apr. 7.94	28	209	1398	1547	143	1018	1658.
677	May 5.20	26	42	298	1914	30	217	2059
678	June 1.41	28	61	495	1580	41	339	1628
679	28.61	27	91	715	1928	65	525	1966
680	July 25.82	27	67	516	2005	48	385	2100
681	Aug. 22.05	27	71	608	1697	50	454	1805
682	Sept. 18.30	28	101	713	1858	72	520	1933
683	Oct. 15.59	27	93	633	1719	73	506	1888
684	Nov. 11.89	27	103	638	1714	89	592	1969
685	Dec. 9.20	26	149	1054	2600	106	750	2813

TABLE II.

Year.	No. of Days on which Photographs were taken.	Mean of Daily Areas.					
		Projected.			Corrected for Foreshortening.		
		Umbrae.	Whole Spots.	Faculae.	Umbrae.	Whole Spots.	Faculae.
1901	359	14	41	23	86	29	29
1902	349	14	86	163	10	62	178
1903	350	67	434	870	51	339	969
1904	363	93	653	1639	67	488	1761

TABLE III.

No. of Rotation.	Date of Commence- ment of each Rotation.	No. of Days on which Photo- graphs were taken.	Spots north of the Equator.		Spots south of the Equator.		Mean Heli- graphic Latitude of Entire Spotted Area.	Mean Distance from Equator of all Spots.
			Mean of Daily Areas.	Mean Heli- graphic Latitude.	Mean of Daily Areas.	Mean Heli- graphic Latitude.		
672	1903. d Dec. 20.64	26	163	18°70	124	16°59	+ 3°40	17°78
673	1904. Jan. 16.98	27	312	16°82	144	14°70	+ 6°87	16°20
674	Feb. 13.32	26	68	15°73	229	13°82	— 7°08	14°25
675	Mar. 11.65	27	276	13°63	72	17°39	+ 7°23	14°40
676	Apr. 7.94	28	302	14°58	717	14°49	— 5°88	14°52
677	May 5.20	26	72	17°13	145	20°09	— 7°78	19°11
678	June 1.41	28	267	16°03	72	18°82	+ 8°62	16°63
679	June 28.61	27	254	15°05	272	18°97	— 2°52	17°05
680	July 25.82	27	200	15°45	185	16°49	+ 0°10	15°95
681	Aug. 22.05	27	54	18°77	400	17°62	— 13°28	17°76
682	Sept. 18.30	28	271	18°95	249	19°81	+ 0°39	19°36
683	Oct. 15.59	27	300	12°26	206	18°34	— 0°15	14°73
684	Nov. 11.89	27	477	19°06	115	19°98	+ 11°50	19°24
685	Dec. 9.20	26	629	17°04	121	16°44	+ 11°65	16°95

TABLE IV.

Year.	No. of Days on which Photographs were taken.	Spots north of the Equator.		Spots south of the Equator.		Mean Heliographic Latitude of Entire Spotted Area.	Mean Distance from Equator of all Spots.
		Mean of Daily Areas.	Mean Heliographic Latitude.	Mean of Daily Areas.	Mean Heliographic Latitude.		
1901	359	22	8°59	6·6	16°27	+2°82	10°37
1902	349	42	18·81	21	15·29	+7·48	17·64
1903	350	133	18·12	206	21·10	-5·75	19·93
1904	363	268	16·33	220	16·88	+1·37	16·57

2. Not only has the general increase of activity in 1904 been slight, but no single rotation of the year has equalled either the 11th or 12th rotations of 1903 in spotted area, and only one—that beginning 1904 April 7, No. 676—has approached them. For the rest of the year the spot activity has been fairly evenly distributed, with a tendency to increase as the year went on.

3. The faculae have shown a much more marked increase than the spots, the advance on 1903 being 82 per cent. The progress has gone on steadily throughout the year, the last rotation showing much the greatest area for the faculae.

4. Comparing the whole spots of the two hemispheres, the area for the northern has been to that of the southern as 55 to 45. This is a return to the precedent of the two preceding cycles, in so far that the northern hemisphere showed a superiority over the southern during the years of chief increase of the solar activity in those two cycles; but is a departure from their precedent in that the balance had swung over to the southern side by the time that the amount of increase had become as small as 44 per cent. The near approach to equality between the two hemispheres would mean, according to the precedent of the last two cycles, that the maximum had not yet been reached, but might be expected in 1905 or early in 1906.

5. Neither hemisphere has been undisturbed for a complete rotation at any time during 1904.

6. Nor was there a single day without spots in the year. This is in sharp contrast to 56 such days in 1903, 248 in 1902, and 289 in 1901.

7. The distribution of spots in latitude in each hemisphere, equally with their distribution between the two hemispheres, appears to point to the near approach of the maximum. The chief spot activity has lain between 24° and 10° in both hemispheres, but has not been restricted to it, for there has been occasional action over the entire zones 33° to 6°, and one or two instances of sporadic spots outside even these wide limits have been noticed. Thus on 1904 November 28 a spot was seen in N. lat. 41°, and on November 29 another in N. lat. 38°; whilst an equatorial group was observed on 1904 January 1. The

appearance of spots over so wide a range of latitude is usually an indication that the maximum is close at hand.

8. The comparison of the mean distance from the equator of all spots for 1904 with the corresponding years of the two preceding cycles is interesting, and marks the present cycle as decidedly unlike the two preceding cycles in its progress. The centre of gravity of the spot-zone has already approached considerably nearer to the equator than in the year before maximum of those two cycles, but the area attained is much smaller. The area in fact is that of nearly three years before maximum, but the mean distance from the equator approaches that of the year of maximum, as the following little table will show :

TABLE V.				
Cycle.	Date of Maximum.	Year.	Mean Distance from Equator of all Spots.	Mean Daily Area of Whole Spots.
1879-1889	1883·9	1880	19 ^o 80	416
		1881	18 21	730
		1882	17·81	1002
		1883	13·04	1155
1890-1901	1893·9	1890	21·99	99
		1891	20·31	569
		1892	18·39	1214
		1893	14·49	1464
1902-	1904	16·57	488

9. The number of separate groups of spots was 84 per cent. greater than in 1903, so that the average size of the groups was not quite as great as in the earlier year. There was no single group at all comparable in area with the great group of 1903 October 4-17. In all, the groups of 1904 were 276 in number, 165 being in the northern hemisphere and 111 in the southern.

Royal Observatory, Greenwich :
1906 January 8.

Observation of Comet b 1904 (Encke) from a Photograph taken with the 30-inch Reflector of the Thompson Equatorial at the Royal Observatory, Greenwich.

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Date and G.M.T. 1904	Apparent R.A.	Apparent Dec.	Log. A.	Corr. for R.A.	Parallax Dec.
d h m s	h m s	° ' "		s	"
Dec. 7 6 42 19	20 50 20·95	+ 5 51' 24"·6	9·6830	+ ·53	+ 13"·3

Royal Observatory, Greenwich :
1906 January 5.